Section: Pathology

Original Research Article

A STUDY OF IMPORTANCE OF BONE MARROW EVALUATION IN PANCYTOPENIA

R.Manasa Reddy[1], Siva Chaithanya Bangi[2], Manchinella Sai Apoorva[3], Kayla Geetha[4]

[1]*Assistant Professor, Government Medical College, Maheshwaram, Telangana, India*
[2]*Associate professor, Government Medical College, Wanaparthy, Telangana, India*
[3]*MediCiti Institute of Medical Sciences, Telangana, India*
[4]*Professor, Government Medical college, Mulugu, Telangana, India.*

Received *: 12/05/2025*
Received in revised form *: 03/07/2025*
Accepted *: 22/07/2025*

Corresponding Author:
Dr. Siva Chaithanya Bangi,
Associate professor, Government medical college, Wanaparthy, Telangana, India
Email: chinnababub30@gmail.com

DOI: 10.70034/ijmedph.2025.3.403

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (3); 2186-2188

ABSTRACT

Background: Pancytopenia is the simultaneous presence of anemia, leucopenia and thrombocytopenia. Peripheral pancytopenia may be a manifestation of a wide variety of disorders which primarily or secondarily affects the bone marrow. It is also essential that physicians practicing primary care in this region should be aware of the common prevalent causes of pancytopenia and their necessary work-up.

Materials and Methods: A prospective study was conducted in the Upgraded Department of Pathology, Osmania government general hospital during July 2022 to June 2024that evaluated 268 patients fulfilling the criteria of pancytopenia. Detailed history, thorough clinical examination, complete hemogram, peripheral examination and reticulocyte count evaluation was performed in all the 268 patients. Bone marrow aspiration was performed in all 268 patients and in addition trephine biopsy was done in the same setting in patients where it is indicated.

Results: The patients aged from 15 to 75 years, average age at presentation was 35.9yrs. The most common cause of pancytopenia was Megaloblastic anemia (58%) followed by leukemia/lymphoma (18%), aplastic anemia (16%) and ITP (3%). Majority (58%) of the patients had hyper cellular bone marrow followed by hypo cellular (34%) and norm cellular marrow (8%).

Conclusion: Detailed primary hematological investigations coupled with bone marrow examination viewed in light of the history and physical findings are vital in establishing the diagnosis in pancytopenia patients. Bone marrow Aspiration and Trephine biopsy are complementary to each other in cases requiring both the procedures.

Keywords: Pancytopenia, Megaloblastic anemia, Aplastic anemia, Bone marrow examination.

INTRODUCTION

The bone marrow is the largest and most widely distributed organ in the body. It is the principle site for blood cell formation. In the normal adult, its daily production and export of blood cells amounts to about 2.5 billion red cells, 2.5 billion platelets and 1.0 billion granulocytes per kilogram of body weight.[1]

"Pancytopenia" is defined as the decrease in all the three formed elements in the blood that is erythrocytes, leucocytes and platelets which results in anemia, neutropenia and thrombocytopenia.[2]

Pancytopenia therefore exists in the adult when hemoglobin level is less than 13.5 g/dl in males or 11.5 g/dl in females; leucocyte count is less than 4 x 109/L and platelet count is less than 150 x 109/L.[3]

Underlying pathology determines the management and prognosis of the patients.[4]

Pancytopenia is a serious hematological problem, the underlying cause of which is diagnosed by bone marrow aspiration and biopsy. Bone marrow examination is extremely helpful in the evaluation of pancytopenia.[5]

MATERIALS AND METHODS

The present study was conducted in the Upgraded Department of pathology, Osmania Medical College,

Hyderabad on patients with pancytopenia during the period of July 2022 to June 2024

Study design: Prospective study.

Study period: The present study was conducted during July 2022 to June 2024

Method of collection of data

Source of Data: Patients diagnosed as pancytopenia after hemogram in the Upgraded Department of Pathology at Osmania Government General Hospital, Hyderabad.

Sample size: 268 Patients with pancytopenia.

Sampling procedure: Data collected from the records of Hematology section of Upgraded Department of Pathology, Osmania government general Hospital Hyderabad.

Selection criteria

Inclusion Criteria

1. Patients with age more than or equal to 15 years.
2. Patients with pancytopenia.

Hemoglobin: Less than 13.5 gm/dL in males; 11.5 gm/dL in females.

Total leucocyte count less than 4000 /cmm.

Platelet count less than 1, 50,000 /cmm.

Exclusion Criteria

1. Patients with age less than 15 years.
2. Patients on cancer chemotherapy.

Procedure: The study was approved by the Ethical and Research Committee of Osmania government general Hospital, Hyderabad. During the study period, all patients presenting with and fulfilling the inclusion criterion were included in this study after obtaining informed written consent.

All patients underwent bone marrow examination. These patients were subjected to routine hematological investigations.

The peripheral smear was studied after staining with Leishman's stain. Satisfactory samples of bone marrow can usually be aspirated form the sternum, iliac crest or anterior or posterior iliac spines. bone marrow and stain them with Romanowsky dyes as peripheral blood films. A trephine biopsy and aspiration biopsy can be carried out through the same skin incision but with the bone being entered at two different points. Fix the specimen in 10% formalin solution buffered to pH 7. Sections of marrow should be stained as a routine by haematoxylin and eosin.

RESULTS

Patient's age ranged from 15 to 75 years. Maximum number of cases was in the age group of 15 to 24 years (38%). Out of 268 patients, 155 patients (58%) were males and 113 patients (42%) were females. Accounting a ratio of male to female was 1.3:1.

The commonest presenting complaints were generalized weakness (73%) followed by pallor (52%), dyspnea (22%), fever (18%).

Among total 268 cases splenomegaly (37%), icterus (35%), hepatomegaly (19%) and lymphadenopathy (5%) was seen on clinical examination.

Sixty percent (60%) of patients had hemoglobin value less than or equal to 6 gm%.

Majority 55% had total leucocyte between 2100 to 3000 cells/cmm followed by 45% had between 3100 to 4000 cells/cmm.

Patients (68%) whose platelet count was less than or equal to 50000 cells/cmm had more bleeding tendencies as compared to patients who had platelet count of more than 50000 cells/cmm.

Majority (64%) of the patients had dimorphic blood picture on peripheral smear followed by Microcytic hypochromic picture (20%).

Majority (58%) of the patients had hyper cellular bone marrow followed by hypocelluar (16%).

On bone marrow evaluation the most common cause of pancytopenia was Megaloblastic picture seen in 155cases (58%) followed by leukemia/lymphoma 48cases (18%), aplastic anemia 42cases (16%), myelofibrosis 8cases (3%),ITP 8cases (3%), multiple myeloma 4cases (1%) and storage diseases 3casaes (1%).

In majority of patients of megaloblastic anemia bone marrow is hyper cellular (93.5%). Majority of patients in megaloblastic anemia had iron stores 1+ (50%) when graded after perls stain.

48cases (18%) out of 268 patients of pancytopenia were due to malignancy of hematolymphopoietic system involving the marrow.

4 (1%) out of 268 cases with majority falling in age group of 45-54yr with peripheral blood picture showing Normocytic hypochromic (50%)/ Microcytic hypochromic (50%) had hypercellular (50%) to hypo cellular marrow (50%), had marrow plasmacytosis with marrow plasma cells more than 10%

The commonest indications for trephine biopsy were to investigate Hypo plastic marrow and dry tap in our institution.

DISCUSSION

In the present study out of 268 cases of pancytopenia were studied and there hematological and bone marrow evaluation was done the most common cause was Megaloblastic anemia (58%) followed by leukemia/lymphoma 48cases (18%), aplastic anemia 42cases (16%).

The commonest cause of pancytopenia, reported from various studies throughout the world has been aplastic anemia or Megaloblastic anemia.[7] In our present study the commonest cause of pancytopenia was megaloblastic anemia. This seems to reflect the higher prevalence of nutritional anemia in Indian subjects as well as in developing countries.

The principal hematologic manifestations are varying degrees of anemia, leucopenia and thrombocytopenia, anisopoikilocytosis, macro ovalocytes and hypersegmented neutrophils.

In the present study, In majority of patients (64%) red blood cell morphology was dimorphic with

anisopoikilocytosis. In majority of patients the reticulocyte count falls in range of 0.1-2%.

Erythroid hyperplasia with megaloblastic maturation was seen in all the 58% of patients.

Gagandeep Kaur et al,[6] in their study studied 784 bone marrow aspirations performed during a 69 months' period, 9cases (1.1%) patients showed metastatic/malignant bone marrow involvement. In present study 48 (18%) out of 268 cases of pancytopenia were cases of malignant /metastatic deposits involving the bone marrow which indicates that this subset of cases varies according to the population covered and the referral done to that particular tertiary care center.

In patients with MM, pancytopenia may be due to: (1) heavy BM infiltration by plasma cells causing BM failure, (2) drugs causing myelosuppression such as cytotoxic chemotherapy and antimicrobials, (3) infections such as septicemia or leishmaniasis, (4) renal failure induced erythropoietin deficiency, (5) cytokine-mediated BM failure, (6) fas-ligand-mediated apoptosis, and (7) associated: Myelodysplastic Syndrome (MDS), aplastic anemia, vitamin B-12 deficiency and auto- immune disorders such as idiopathic thrombocytopenic purpura,

Evan's syndrome, autoimmune hemolytic anemia and pernicious anemia.[8]

In our study multiple myeloma cases were 1% of total cases. The presence of pancytopenia may be misleading in such cases and hence may be a cause for delay in the diagnosis and treatment. A differential of myeloma must be thought of in elderly patients with pancytopenia as it can be easily diagnosed by bone marrow examination and quantitative serum protein electrophoresis.[9-12]

CONCLUSION

The etiological spectrum of pancytopenia is diverse. The present study reveals megaloblastic anemia is the commonest cause in Indian scenario where the etiology is nutritional and wide spread use of certain traditional medicines unknown.

Bone marrow examination is an important diagnostic tool in hematology which is instrumental in confirming the underlying diagnosis, or excluding a primary marrow involvement and suggesting alternative investigations for diseases like hypersplenism, PNH etc.

Bone marrow aspiration is sufficient to make a diagnosis in cases of nutritional anemia's and initial diagnosis of leukemia. However, aspiration is often unsuccessful and may yield a dry tap in patients with aplastic anemia or myelofibrosis or metastatic deposits in marrow. Bone marrow trephine biopsy is essential for diagnosis in such conditions or when the aspiration is inconclusive.

REFERENCES

1. Hoffman R, Benz EJ, Shattil SJ, Furie B, Cohen HJ, Siberstein LE. Hematology. Basic Principles and practice. 3rd ed. USA: Churchill Livingstone; 2005.
2. Ur-Rehman H, Fazil M, Mohammad F. Clinical presentation of pancytopenia in children under 15 years of age. J Postgrad Med Inst 2003; 17(1): 46-51.
3. Firkin F, Chesterman C, Penington D, Rush B. De Gruchy's Clinical haematology in Medical Practice. 5th Ed. Oxford: Blackwell; 1989.
4. Varma N, Dash S. A reappraisal of underlying pathology in adult patients presenting with pancytopenia. Trop Geogr Med 1992; 44(4): 322-7.
5. Dodhy MA, Bokhari N, Hayat A. Aetiology of Pancytopenia, A five-year experience. Ann Pak Inst Med Sci 2005 Apr-Jun;1 (2):92-5.
6. Gagandeep Kaur, Sabita Basu, Paramjit Kaur and Tanvi Sood: "metastatic bone marrow tumors: study of nine cases and review of the literature"; J Blood Disorder and Transfusion 2011; Vol 2, Issue 3:2-3.
7. Clinico-hematological study of pancytopenia: A single-center experience from north Himalayan region of India, Harish Chandra et al. Journal of Family Medicine and Primary Care. Volume 8 : Issue 12 : December 2019.
8. Debord C, Touzeau C, Theisen O, Béné MC, Eveillard M. Rapid Evolution of a Myelodysplastic Syndrome in a Case of Multiple-Myeloma: Therapy Related or Not? Ann Hematol Oncol. 2017; 4: 1147.
9. Medhi K, Kalita D, Chopra A, Anand M, Raina V, Kumar R. Multiple myeloma presenting with coexisting severe marrow hypoplasia. Indian J Pathol Microbiol. 2008; 51: 543-545.
10. Papakonstantinou G, Koutsis D, Spyridonidis A. Successive pancytopenia as indication for myeloma treatment – a rare case of visceral leishmaniasis. Memo - Mag Eur Med Oncol. 2010; 3: 191-193.
11. Shimanovsky A, Alvarez AJ, Murali S, Dasanu CA. Autoimmune manifestations in patients with multiple myeloma and monoclonal gammopathy of undetermined significance. BBA Clin. 2016; 6: 12-18.
12. Hanaganahalli B Sridevi et al., Pancytopenia in Multiple Myeloma- An Enigma: Our Experience from Tertiary Care Hospital Journal of Clinical and Diagnostic Research. 2015 Nov, Vol-9(11): EC04-EC06.